CHAPTER III

III. WATERSHED CHARACTERISTICS

A. General Hydrology and Topography

1. Topography

The Webster Lake watershed encompasses an area of approximately 11,432 acres and contains 2 major lakes, numerous small ponds and an extensive system of tributaries. The majority of the watershed -- 8,363 acres (73.2% of the total basin)-- lies within the eastern portion of the town of Andover, New Hampshire. It is dominated by rapidly fluctuating terrain, typical of the lakes region, which contains a mixture of steep slopes and mountainous terrain, rolling hills and relatively flat farmland. Elevations range from 1,300± feet northeast of Highland Lake to 400± feet near the Webster Lake outlet.

The watershed is dominated by Highland Lake in Andover, and Webster Lake in Franklin. The two lakes are connected by Sucker Brook, the largest of the tributaries within the watershed. Sucker Brook is surrounded by relatively flat areas which are dominated by active and inactive agriculture and New Hampshire Route 11. Other gently sloping areas are found surrounding both tributary inflow points and connections throughout the watershed.

2. Hydrology

This study concentrated primarily on Sucker Brook, the main tributary, which drains approximately 80% of the watershed and contributes 76% (normalized year) of the total water input to Webster Lake (excluding precipitation). Five stations were monitored along the course of Sucker Brook itself, and four stations at tributaries emptying into Sucker Brook. Tributary hydrology was monitored using staff gages, measuring actual flows using a Marsh-McBirney flowmeter and at one station by use of a liquid level recorder.

B. Climate

The climate of the region is characterized by moderately warm summers, cold, snowy winters and sufficient rainfall. Prevailing winds are generally from the west and northwest. The area's weather is occasionally influenced by the Atlantic Ocean. Daily temperatures can be quite variable because of changing weather systems that alternately transport warmer air from a southerly direction and colder air from a northerly direction. Table III-1 presents precipitation data collected by the New Hampshire Weather Bureau for the duration of the study.

C. Soils

The Water Quality Management Investigation (Dufresne-Henry Inc. and WS&PCC 1981) describes the Webster Lake watershed as containing "a broad spectrum of soils". The report provided a list of thirty-seven distinct soil types identified in the watershed that were further clustered into eight broad soil condition categories. Table III-2 shows the soil types within each category. The soil condition categories are defined as follows:

> WETLAND SOILS are the organic soils; muck, peat and marsh; non-stony and very stony, poorly and very poorly drained mineral soils. The water table ranges typically at or near the ground surface from 5 to 9 months of the year. Some of these soils have standing water on them most of the year.
>
> SEASONALLY WET SOILS include all moderately well drained soils. The water table rises within 1 - 2 1/2 feet from the ground surface in wet seasons.
>
> ALLUVIAL SOILS ON THE FLOOD PLAINS include all drainage classes that are of stream deposited materials subject to flooding. Some of these flood plain soils are also wetland soils. These few soils will appear in both categories.
>
> SAND AND GRAVEL DEPOSITS are excessively and well drained soils on glacial outwash and stream terraces consisting of stratified layers of sand and gravel. Outwash refers to deposition of material by melt water as it flowed from glacial ice.

Table III-1. Precipitation Data

Month/Year	Precipitation (inches)	*Record Monthly Mean
Oct 87	4.14	---
Nov 87	2.50	---
Dec 87	1.55	---
Jan 88	1.97	2.92
Feb 88	2.24	2.61
Mar 88	1.32	3.08
Apr 88	2.75	3.00
May 88	3.35	3.14
Jun 88	0.80	3.31
Jul 88	6.53	3.56
Aug 88	5.44	3.39
Sep 88	1.56	3.36
Oct 88	1.23	3.17
Nov 88	5.06	3.46
Dec 88	1.05	3.05

Total precipitation during study 41.49

*Mean calculated from data for years 1959-1988

Table III-2.
Soil Categories and Soil Types.

Wetland Soils
- Au - Au Gres loamy sand
- Ag - Au Gres find sandy loam
- Mh - Fresh water Marsh
- Mp - Muck and Peat
- Rd - Ridgebury and Whitman very stony loam
- Ru - Rumney fine sandy loam/Limerick fine sandy loam
- Sa - Saco silt loam
- Sc - Scarboro fine sandy loam

Seasonally Wet Soils
- Ac - Acton fine sandy loam; Acton and Acton firm substratum fine sandy loams
- Ad - Acton very stony fine sandy loam; Acton and Acton firm substratum very stony fine sandy loams
- Bc - Belgrade silt loam
- Du - Duane fine sandy loam
- Su - Sudbury fine sandy loam
- Wo - Woodbridge loam
- Wv - Woodbridge very stony loam

Alluvial Soils on the Flood Plains
- Sa - Saco silty loam
- Ru - Rumney fine sandy loam

Sand and Gravel Deposits
- Co - Colton loamy sand
- Ct - Colton gravelly loamy sand
- Hs - Hinckley loamy sand
- Hr - Hinckley gravelly loamy sand
- Wd - Windsor loamy sand, dark mineral substratum phase

Wetland Soils on Flood Plains
- Lm - Limerick silt loam
- Ru - Rumney fine sandy loam

Non-hardpan Soils
- Gc - Gloucester sandy loam
- Gr - Gloucester very stony sandy loam
- Gs - Gloucester extremely stony sandy loam
- Hm - Hermon fine sandy loam
- Ho - Hermon extremely stony sandy loam

Hardpan Soils
- Pa - Paxton fine sand loam
- Pn - Paxton very stony fine sandy loam

Shallow to Bedrock Soils
- Ca - Canaan-Hermon very rocky sandy loams
- Ch - Canaan-Hermon extremely rocky sandy loams
- Sg - Shapleigh-Gloucester sandy loams
- So - Shapleigh-Gloucester extremely rocky sandy loams

WETLAND SOILS ON FLOODPLAINS inlcude wetland classes that are stream deposited material subject to flooding.

NON-HARDPAN include the well drained soils formed in material called glacial till. The till consists of varying amounts of different size fragments ranging in size from clay to boulders which were deposited directly from the glacier with little or no water transport.

HARDPAN SOILS include the moderately well-drained and well-drained soils formed in glacial till having a distinct compact hardpan layer which retards the downward movement of water.

SHALLOW TO BEDROCK SOILS include somewhat excessively drained soils formed in glacial till. They are predominantly shallow to bedrock soils intermingled with deeper soils. Outcrops are few to many.

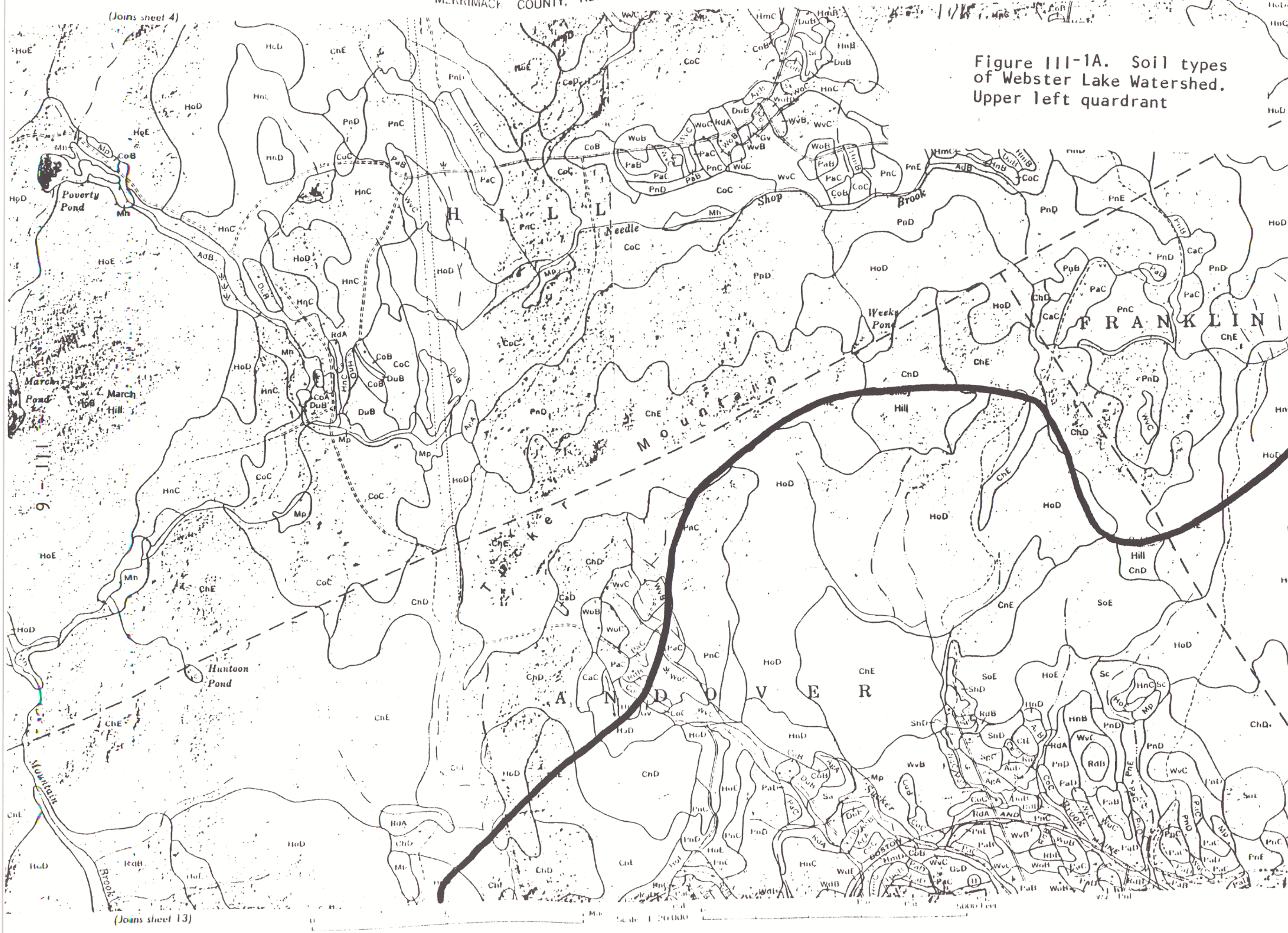
Figure III-1 illustrates the soil types present within the watershed, while Figure III-2 shows, schematically, how the major soil types relate to topography. The following is a description of the dominant soil types of the Sucker Brook watershed (United States Department of Agriculture Soil Conservation Service, 1965).

The headwater of Sucker Brook exits Highland Lake and travels northward encountering many soils within its immediate watershed. The dominate soil surrounding the beginning of Sucker Brook at the Highland Lake outlet is Hinckley loamy sand with 0 to 8 percent slopes. These soils developed in water-sorted sand and gravel derived from granite, gneiss and schist. The movement of water is very rapid through these soils and their moisture-holding capacity is very low. These soils leach rapidly because they are loose and open. The limitation for development is the potential groundwater pollution when the soils are used for waste disposal (Pilgrim and Peterson, 1979).

As the brook continues to flow north it passes through a large area from muck and peat. This soil type consists of deposits of organic matter upward of 12 inches in depth. This area is very wet and frequently flooded by runoff from higher areas.

The brook turns east paralleling the railroad tracks. During its journey east toward Webster Lake, Sucker Brook passes through an area predominantly made up of Woodbridge, Paxton and Ridgebury & Whitman.

Figure III-1A. Soil types of Webster Lake Watershed. Upper left quardrant



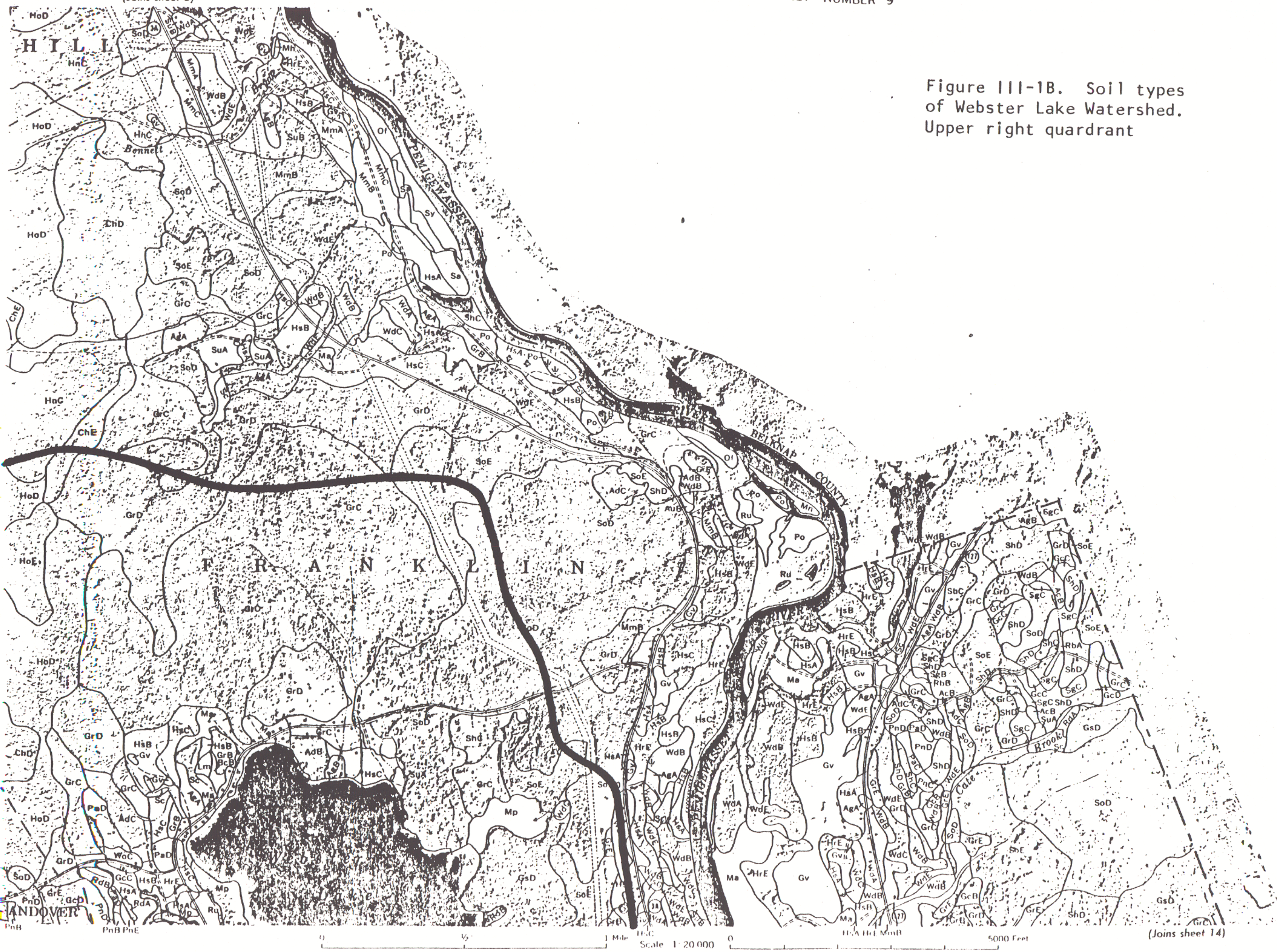


Figure III-1B. Soil types of Webster Lake Watershed. Upper right quardrant

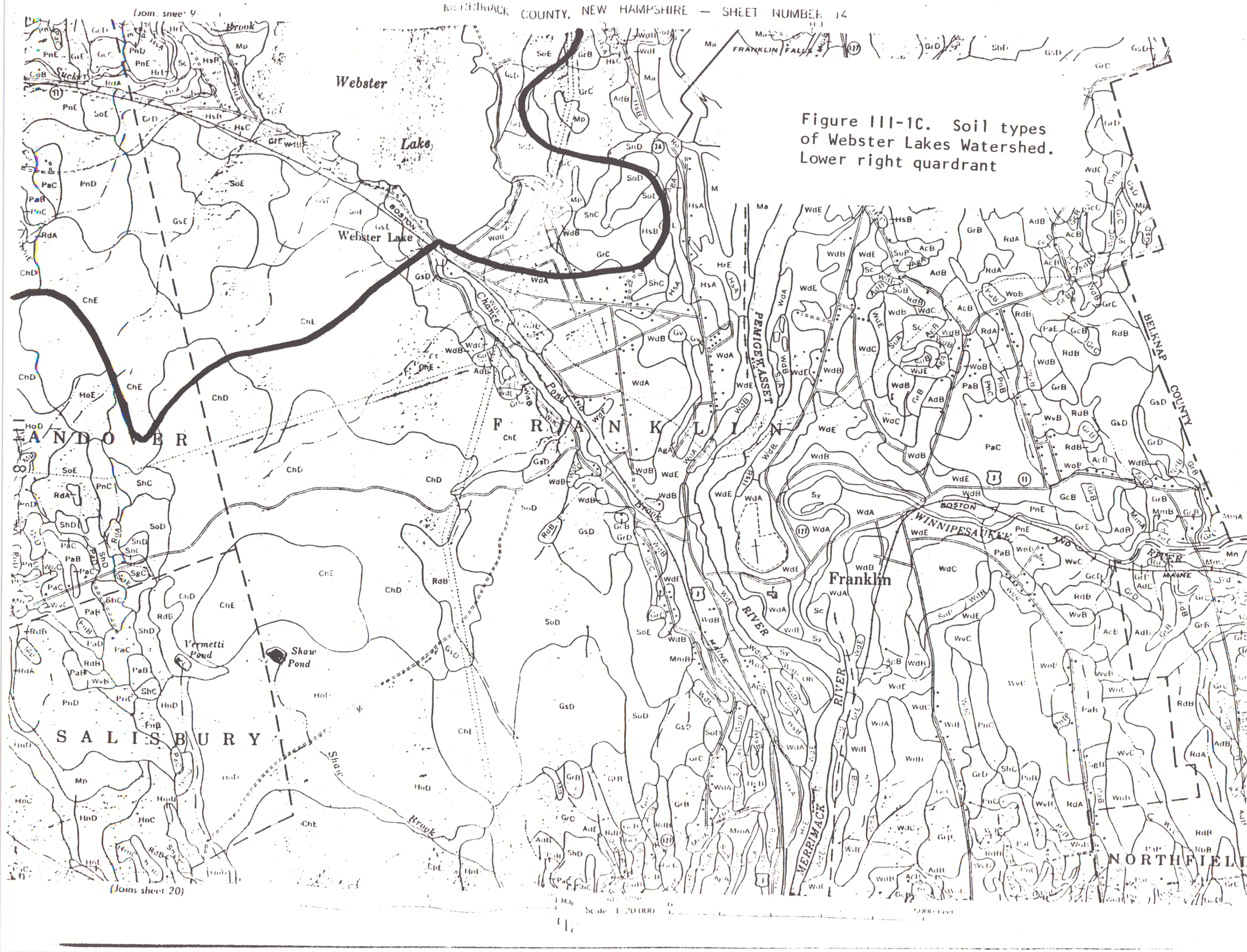
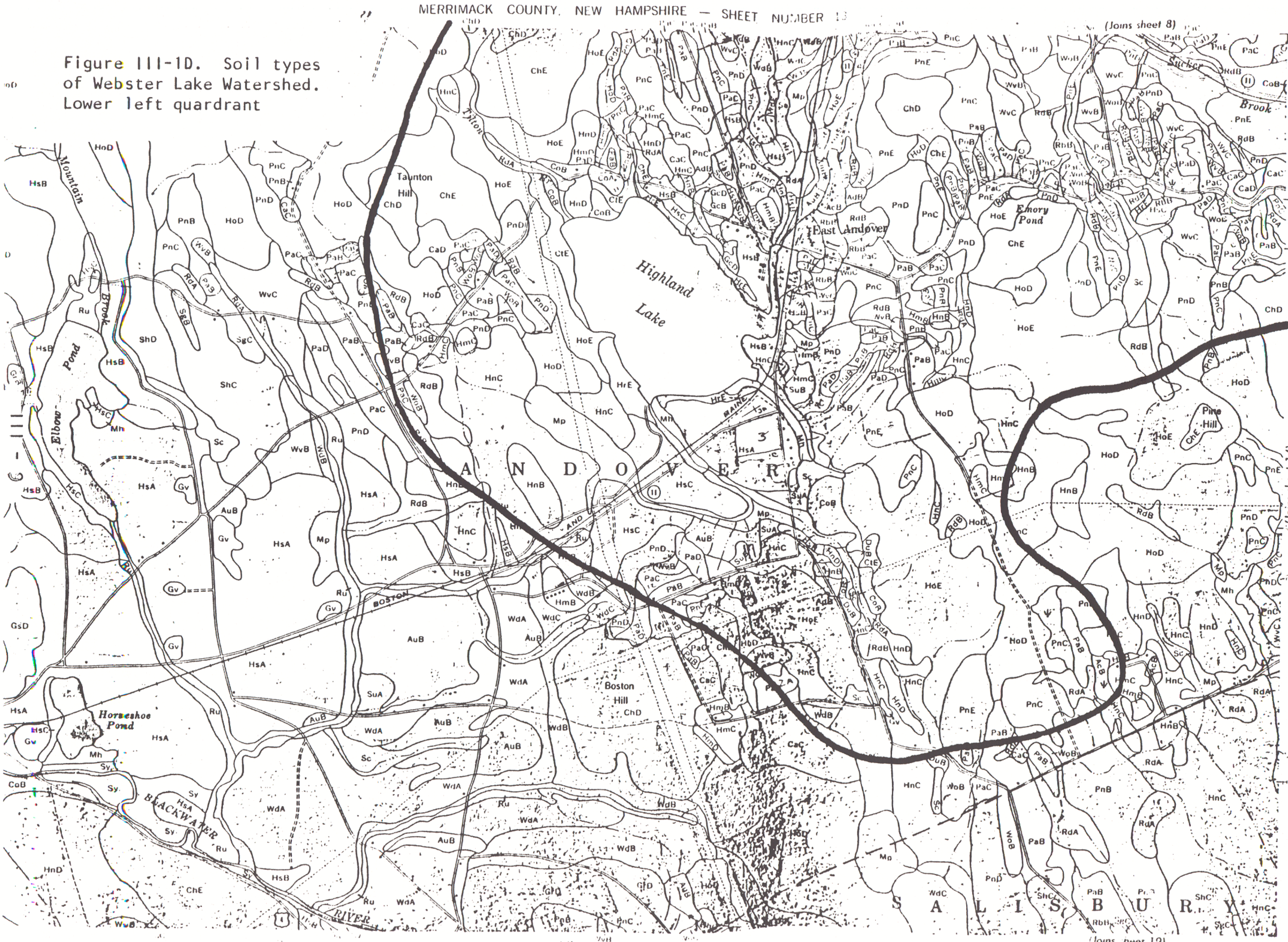


Figure III-1C. Soil types of Webster Lakes Watershed. Lower right quardrant

Figure III-1D. Soil types of Webster Lake Watershed. Lower left quadrant



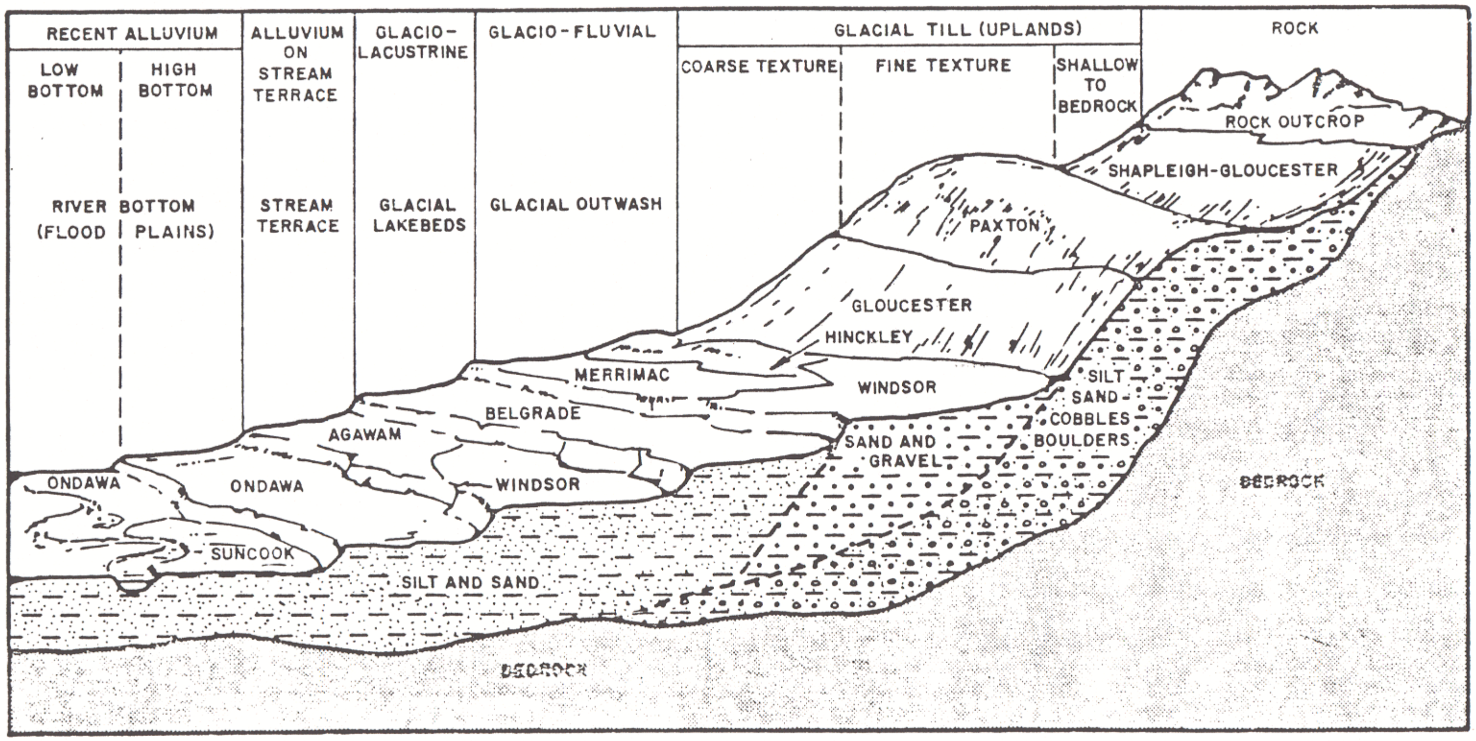


Figure III-2 Typical landscape showing the relationship to the kinds of soil.

*Soil Manual for Site Evaluations in New Hampshire

As the brook changes course from north to east, the first area it passes through is largely Woodbridge soil. Woodbridge soils are moderately well drained soils in glacial till that have a pan layer about 24 inches from the surface. Stones and boulders occur throughout the profile. Water movement through these soils is moderate above the pan layer and slow within the pan. These soils usually contain excessive water during wet periods, but hold enough moisture for plants during dry periods. The common slope of the Woodbridge soil present is 0 - 15 percent. The presence of a hardpan layer and a seasonal high water table in Woodbridge soils must be considered in development planning (Pilgrim and Peterson, 1979).

As Sucker Brook continues to flow eastward the dominate soil surrounding the brook is Paxton. These soils are formed from mica schist, gneiss and granite. The pan layer occurs 18 to 24 inches below the surface. Water movement is moderate above the pan layer but slow through the pan. Generally, Paxton soils have a seasonal high water table and bedrock outcrops. The Paxton soils are among the best upland agricultural soils in Merrimack County. The presence of a hardpan layer in these soils must be considered in planning any development.

Two soil types of the Paxton series found in the watershed are Paxton loam and Paxton very stony loam. The Paxton loam slopes less and has fewer stones on the surface than Paxton very stony loam.

The brook passes directly through large areas of Ridgebury & Whitman soils. These soils are poorly drained in glacial till, with a pan layer depth at 12 to 24 inches. These soils are hard when dry while firm and brittle when wet. These strongly acidic soils are nearly level to gently sloping.

D. Watershed Geology

Webster Lake is located in the Merrimack River watershed, which occupies the central portion of New Hampshire, south and west of the main divide of the White Mountains. This moderately hilly basin is composed of a variety of igneous and metamorphic rock of the Paleozoic Age. (Hoover, 1937)

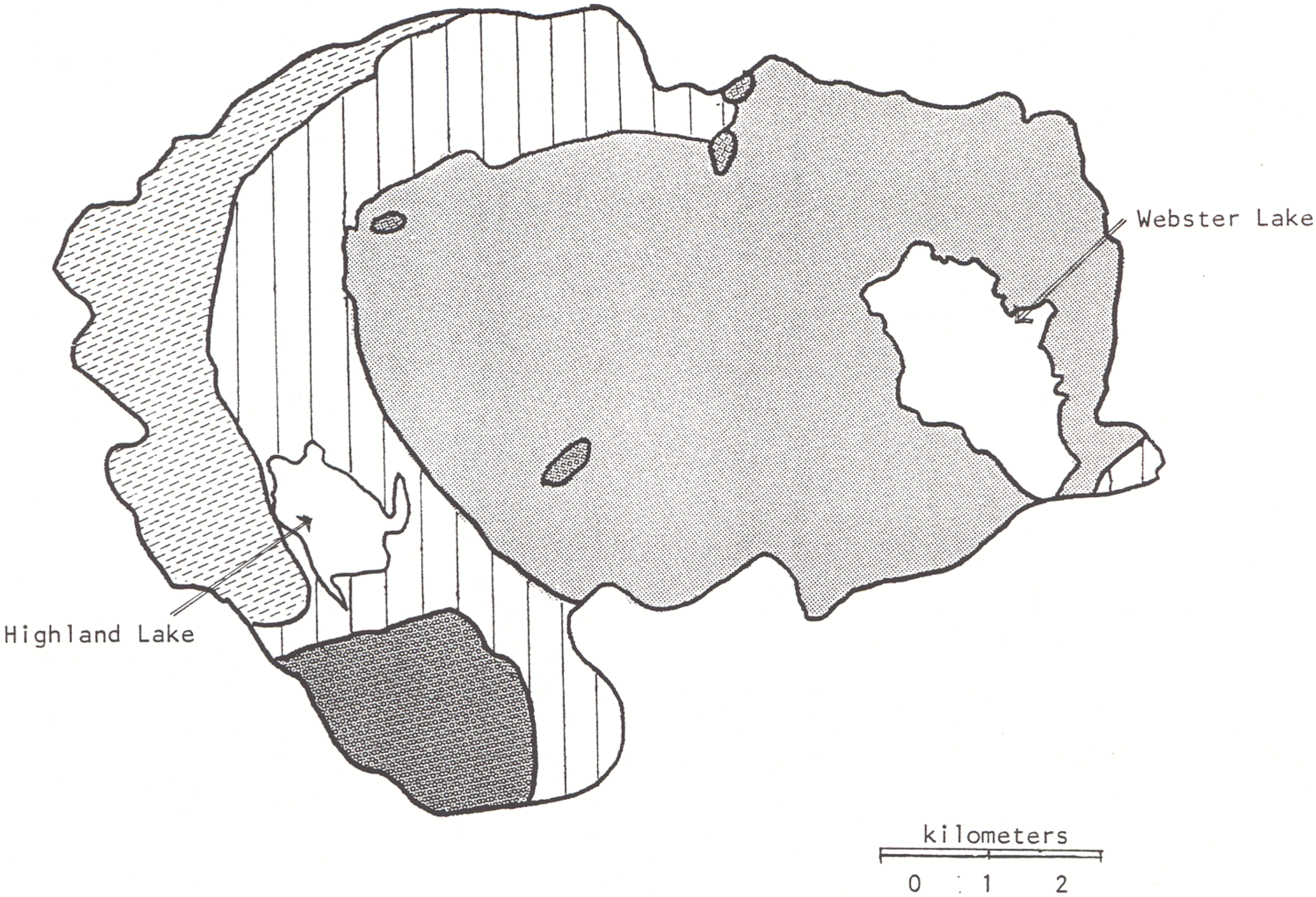
A description of the rock types in the watershed of Webster Lake can be found in Figure III-3. The bedrock contains mostly schists and gneiss(es) with some quartzites interspersed (Eugene Boudette personal communication).

E. Land Use

Lake quality is influenced, in part, by the type of human or natural activities that take place on the land within the confines of the watershed. A watershed can be thought of as an enormous funnel, with the lake or pond located near the bottom. Much of the rainwater, snow melt water and groundwater found within the watershed will ultimately travel to the lowest part of the funnel - that being the lake or pond. The movement of this water may carry pollutants from the watershed. Nutrients such as phosphorus and nitrogen can cause unsightly algae blooms while acidic precipitation can impair aquatic wildlife. Poor farming practices, the buildup of large urban areas, and the clear cutting of native vegetation are the principal human activities that create the pollutants that may impair lake water quality. Human disturbances in a watershed can accelerate the degradation of the lake quality much faster than natural processes.

Land uses throughout the Webster Lake watershed are dominated by vast forested tracts. Existing conditions consist of low-density residential housing, active and inactive agricultural land and widely dispersed commercial and industrial concerns. The greatest concentration of dwellings occur within the first tier of both lakes, with Webster Lake exhibiting a much higher density of shoreline development than Highland Lake. Existing shoreline dwellings traditionally of a seasonal nature, are being winterized at an increasing rate and the majority of new shoreline dwellings are being built as year-round units, thereby altering the nature of the shoreline development (Dufresne-Henry Inc. and WS&PCC, 1981). The lake is almost completely surrounded by a roadway which closely parallels the shoreline. This road layout has encouraged development of the first tier.

Highland Lake has a less intensive pattern of shoreline development. The majority of development occurs along the southwestern sides of the lake.



Srl - Lower Rangely: thinly laminated (5-25 mm) gray metapelite with sporadic lentils of well-developed turbidites and few calc-silicate pods. Thin quartz conglomerates in western N.H. Probably equivalent to Rangely B of Maine.

Sp - PERRY MOUNTAIN FORMATION (SILURIAN)
Sharply interbedded quartzites and gray metapelites; "fast-graded" metaturbidites

Sru - Upper Rangely; rusty-weathering peltic schist, meta sandstone, and local grits; calc-silicate pods commonly present. Probably equivalent to Rangely C of Maine.

Dclm- Gray equigranular two-mica granite, locally grading to tonalite; Concord Granite Intrusive Suite.

(Lyons et al, 1986)

Figure III-3- Rock types in the Webster Lake Watershed.

Dwellings in these areas are primarily seasonal and have not experienced a great deal of winterization. The eastern shoreline is characterized by scattered dwellings set well back from the shoreline. The lack of a roadway closely parallelling the northwestern, northern and eastern shoreline limits the extent to which development can occur at this time (Dufresne-Henry, Inc. and WS&PCC, 1981).

Table III-3 shows current land uses by major drainage basin while Figure III-4 illustrates the major drainage basins within the Webster Lake watershed. The Webster Lake watershed consists of extensive forested land (89%), active and nonactive agricultural sites (10%) and minor amounts of commercial, industrial and high density residential uses. Other minor usages listed are lawn areas and disturbed land in the watershed. Figures for the lakes region area as a whole show 86% forested and 6.1% agricultural (Dufresne-Henry Inc. and WS&PCC, 1981).

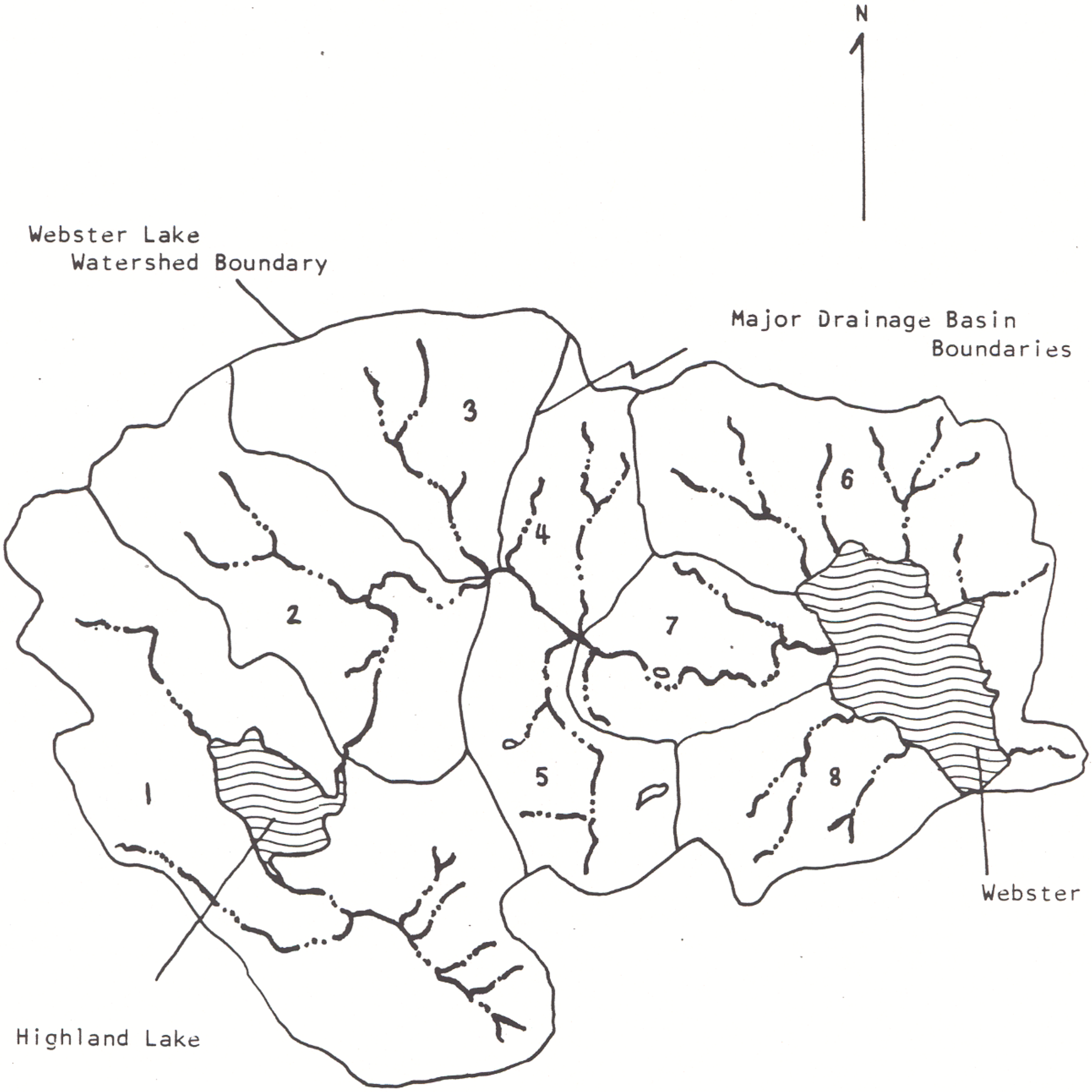
TABLE III-3. Current Land Use
in Webster Lake drainage basin

Drainage Basin*	Ri	Rm	RKl	RKm	RKh	An	Av	It	P	Cn	F
1) A= 1331.61	20.04	--	17.20	5.33	1.61	71.15	41.97	2.21	.70	22.23	1149.16
Lake = 86.03	15.1%	--	12.9%	.04%	.01%	5.34%	3.2%	.02%	--	1.6%	86.3%
2) 714.75	34.49	12.67	--	--	--	29.38	13.98	--	--	--	624.23
	4.8%	1.8%	--	--	--	4.1%	.02%	--	--	--	87.3%
3) 367.86	--	--	--	--	--	15.30	--	--	--	--	347.56
8.4%	--	--	--	--	--	4.2%	--	--	--	--	95.8%
4) 263.77	--	--	--	--	--	11.29	.704	--	--	--	251.75
6.1%	--	--	--	--	--	4.2%	.03%	--	--	--	95.4%
5) 399.68	9.55	--	--	--	--	54.52	88.32	.81	--	--	246.47
9.3%	2.4%	--	--	--	--	13.6%	22.1%	.02%	--	--	61.6%
6) 619.28	17.80	9.56	17.8	13.88	17.40	--	16.60	--	3.88	--	466.87
Lake = 238.53											
14.4%	2.8%	1.5%	2.8%	2.2%	2.8%	--	2.7%	--	9.6%	--	75.4%
7) 243.85	12.67	2.01	1.21	--	--	13.48	15.69	--	--	7.44	191.34
5.7%	5.2%	.82%	.5%	--	--	5.5%	6.4%	--	--	3.1%	78.5%
8) 366.28	5.43	3.62	14.20	9.76	--	--	8.65	--	.40	--	324.20
8.5%	15%	.1%	3.9%	2.7%	--	--	2.4%	--	--	--	88.5%
Basin = 4302.06	99.99	27.87	50.41	28.97	19.01	195.10	185.92	3.02	60.46	29.67	3601.58
	2.32%	.065%	2.03%	.067%	.044%	4.53%	4.32%	--	1.40%	.069%	83.71%

Lake = 324.56
4626.62

Key:
- Rl - low density residential (2 or less homes/600')
- Rm - Medium density residential (3-6 homes/600')
- Rkl - Lake front low density
- Rkm - Lake front medium density
- Rkh - Lake front high density (7 or more homes/600')
- An - Agriculture (Inactive)
- Av - Agriculture (Active)
- It - Industry
- P - Public
- Cn - Conservation
- F - Forest

*Refer to Table III-4, Minor Drainage Basins for Planning Purposes.
All areas given in hectares



Webster Lake
Major Drainage Basins

Figure III-4. Webster Lake Drainage Basins.